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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/776,076	02/10/2004	Madhav Datta	42P11468D	2094

7590 02/23/2005
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EXAMINER

PHAM, THANHHA S

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 02/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/776,076

Applicant(s)

DATTA ET AL.

Examiner

Thanhha Pham

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 August 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 12-22 is/are pending in the application.
- 4a) Of the above claim(s) 15, 16, 20 and 22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 12-13, 17-19 is/are rejected.
- 7) ☒ Claim(s) 14 and 21 is/are objected to.
- 8) ☒ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office Action is in response to Applicant's Response to Restriction Requirement dated 08/24/2004.

Election/Restrictions

1. Applicant's election of claims 12-14, 17-19 and 21 in the reply filed on 08/24/2004 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).
2. Claims 15-16, 20 and 22 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to nonelected species.

Information Disclosure Statement

3. The information disclosure statement filed 02/10/2004 fails to comply with 37 CFR 1.98(a)(1), which requires the following: (1) a list of all patents, publications, applications, or other information submitted for consideration by the Office; (2) U.S. patents and U.S. patent application publications listed in a section separately from citations of other documents; (3) the application number of the application in which the information disclosure statement is being submitted on each page of the list; (4) a column that provides a blank space next to each document to be considered, for the examiner's initials; and (5) a heading that clearly indicates that the list is an information

disclosure statement. The information disclosure statement has been placed in the application file, but the information referred to therein has not been considered.

Oath/Declaration

4. Oath/Declaration filed on 02/10/2004 has been considered.

Drawings

5. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the metallization over which the copper pad and the Ti metal adhesion first layer must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New

Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

6. Claim 18 is objected to because of informality. Appropriate correction is required to clarify the scope of the claim.

► With respect to claim 18,

line 2, "a metal-six (M6) metallization" (metallization level being labeled as metal-six (M6)) should be changed to "a metallization" to clarify the scope of the claim.

line 3, typographical error "the metallization" should be changed to "the copper pad" to clarify the scope of the claim (see fig. 1 and specification pages 4-5 that shows sputtering Ti adhesion first metal layer 26 on and above the copper pad 14).

► With respect to claim 19,

lines 2 and 3, typographical error "the metallization" should be changed to "the copper pad" to clarify the scope of the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 12 and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Chiang [US 2002/0086520].

► With respect to claim 12, Chiang (figs 3-5 and text paragraphs [0001]-[0027])

discloses the claimed process comprising:

forming a metallization (320, fig. 3, text paragraph [0020]) over a substrate (310);

forming a metal adhesion first layer (340a, fig. 3, text paragraph [0021]) above and on the metallization (320);

forming a metal second layer (340b, fig. 3, text paragraph [0021]) above and on the metal adhesion first layer (340a);

forming a metal third layer (340c, fig. 3, text paragraph [0021]) above and on the metal second layer (340b);

forming a solder bump (350, fig. 4, text paragraph [0022]) above and on the metal third layer (340c), and

wherein at least one of the metal second layer and the metal third layer comprises sputtered copper (text paragraph [0025]: *layer 340c comprises sputtered copper*).

► With respect to claim 17, Chiang (text paragraph [0022]) discloses forming an electrically conductive bump (bump electrode 350) above and on the metal third layer (340c).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang [US 2002/0086520] in view of Bhattacharya [US 4,514,751].

Chiang substantially discloses the claimed process including forming the metal adhesion first layer comprising sputtering a composition over the metallization wherein the composition is selected from Ti, TiW, W and Cr (see Chiang, text paragraphs [0021] and [0025]). Chiang use said metal adhesion first layer as a portion of the UBM for solder bump in subsequent process step.

Chiang does not expressly teach forming said metal adhesion first layer by sputtering the composition under conditions to impart a compressive stress in said metal adhesion first layer.

However, Bhattacharya (fig. 1, col. 2 lines 53-58 and col. 3 lines 1-26) teaches forming the metal adhesion layer (Ti) by sputtering/evaporation deposition under conditions to impart compressive stress in the metal adhesion layer (Ti) as a portion of

Art Unit: 2813

the UBM for solder bump (1) to prevent cracking problem when forming the solder bump.

Therefore, at the time of invention, it would have been obvious for those skilled in the art to modify process of Chiang by forming the metal adhesion first layer using sputtering under conditions to impart compressive stress as taught by Bhattacharya to prevent cracking problem when forming the solder bump for electrical connection.

9. Claims 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang [US 2002/0086520] in view of Chen et al. [US 6,667,230].

► With respect to claim 18, Chiang (figs 3-5 and text paragraphs [0001]-[0027]) discloses a process comprising:

forming a copper pad (320, fig. 3, text paragraph [0020]) over a substrate (310);
sputtering a Ti metal adhesion first layer (340a, fig. 3, text paragraph [0021] & [0025]) above and on the copper pad (320);

sputtering a metal second layer (340b, fig. 3, text paragraph [0021] & [0025]) above and on the Ti metal adhesion first layer (340a);

forming a metal third layer (340c, fig. 3, text paragraph [0021]) above and on the metal second layer (340b);

forming a solder bump (350, fig. 4, text paragraph [0022]) above and on the metal third layer (340c), and

wherein at least one of the metal second layer and the metal third layer comprises copper (text paragraph [0025]: *layer 340c comprises sputtered copper*).

Chiang does not expressly teach forming the copper pad (320) over a metallization.

However, forming the copper pad over the metallization has been known in the art of forming a device with multilevel metallization. In addition, Chen et al. (fig. 3 and cols. 7-10) discloses forming the copper pad (16) over the metallization (118).

Therefore, at the time of invention, it would have been obvious for those skilled in the art to modify process of Chiang by forming the copper pad over the metallization as taught by Chen et al. to provide electrical connection for operating the device.

► With respect to claim 19, Chiang (text paragraph [0021] lines 13-14) discloses sputtering a Ti composition over the copper pad wherein the Ti composition has a thickness in a range from about 500Å to about 4000Å (1000 to 2000Å).

Allowable Subject Matter

10. Claims 14 and 21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

11. The following are statements of reasons for the indication of allowable subject matter:

► Recorded Prior Art fails to disclose or suggest the combination of the process steps as recited in the base claim 12 including wherein forming the metal second layer

Art Unit: 2813

and forming the metal third layer further comprising: sputtering a copper metal second layer over the metal adhesion first layer under conditions to impart a compressive stress therein; and sputtering the metal third layer under conditions to impart a compressive stress therein, wherein the metal third layer is selected from a refractory metal, a metal-doped refractory metal, or a refractory metal alloy as characteristics in claim 14.

► Recorded Prior Art fails to disclose or suggest the combination of the process steps as recited in the base claim 18 including wherein forming a metal third layer comprises: sputtering a NiV composition over the metal second layer, wherein the NiV composition has a thickness range from about 1000Å to about 5000Å, and wherein the metal second layer has a thickness in a range from about 1 about 1000Å to about 5000Å as characteristics in claim 21.

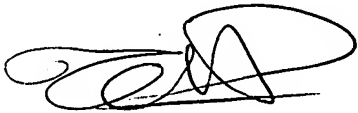
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (571) 272-1696. The examiner can normally be reached on Monday and Thursday 9:00AM - 9:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2813

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to be 'Thanhha Pham', with a large loop at the end.

Thanhha Pham
Patent Examiner
Patent Examining Group 2800